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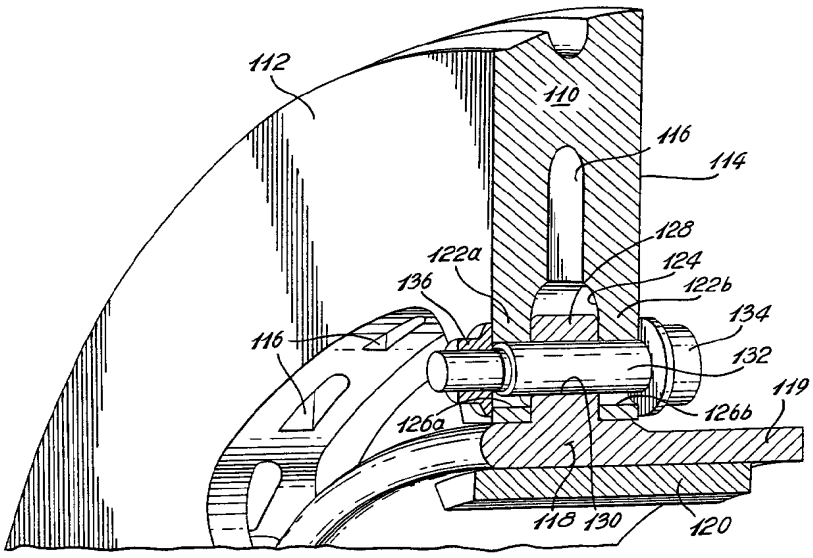
(54) Title: ROTOR DISK ASSEMBLY FOR FULL CONTACT BRAKE



(57) Abstract: A rotor disk (10) assembly for a full contact disk brake assembly comprising a radially extending annular rotor disk (12, 110) having parallel continuous friction surfaces (20, 22, 112, 114) in radial planes and a hub adapter (14, 118) mounted to a wheel of the vehicle. The hub adapter (14, 118) has an annular rim (28, 128) in a radial plane and a cylindrical portion (30, 119) extending parallel to an axis of rotation of the wheel. Nuts and bolts (38, 46, 132, 134) mount the rim (28, 128) of the hub adapter to the annular rotor disk (12, 110) to connect the annular rotor disk (12, 110) to the hub adapter (14, 118), whereby differential thermal expansion can occur between the rotor disk (12, 110) and the hub adapter (14, 118).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

"ROTOR DISK ASSEMBLY FOR FULL CONTACT BRAKE"

Technical Field

The present invention relates to a rotor assembly for a full contact brake, and more particularly, to a rotor assembly made out of two annular parts.

Background Art

Heat remains a serious problem in full-contact brakes, that is, brakes having an annular rotor disk with a continuous radial annular friction surface adapted to be engaged by a continuous annular brake shoe.

The rotor is generally mounted on a hub or hub adapter. While the rotor is made of cast metal, the hub or hub adapter is usually fabricated of a light metal having different thermal expansion properties.

Disclosure of the Invention

It is an aim of the present invention to provide a rotor assembly for a full-contact brake disk assembly wherein the rotor assembly is made in two parts allowing differential thermal expansions between the two parts.

It is also an aim of the present invention to provide a rotor for a disc brake construction having a generally symmetrical cross-section in order to reduce distortion in the brake caused by thermal growth.

A construction in accordance with the present invention comprises a rotor assembly including an annular rotor disk with inward projections, the rotor disk having at least one radial friction surface, a hub adapter having a cylindrical component and a radial rim, fastener means extending between the radial rim of the hub adapter and the inner projection of the annular rotor disk to connect the hub adapter to the annular rotor disk in order to permit differential thermal expansion to occur between the annular rotor disk and the cylindrical hub adapter.

More specifically, the annular rotor disk is made of a first material and the hub adapter is made of a second material.

In another aspect of the present invention, there is provided a rotor assembly, for a full contact annular disk brake, comprising a hub adapter, an annular rotor disk connected to the hub adapter, the improvement comprising radial components on the hub adapter, the annular rotor disk having a complementary connecting means securing the annular rotor disk to the radial component on the hub adapter, the radial components on the hub adapter and the connecting means on the annual rotor disk including circumferentially spaced-apart pairs of symmetrical, axially spaced-apart members on one of the rotor disk and the hub adapter; and circumferentially spaced-apart unitary members on the other of the rotor disk and hub adapter; and each unitary member adapted to fit between a corresponding pair of axially spaced-apart members; a first set of aligned bores extending through each pair of axially spaced-apart members and a second bore extending through the corresponding unitary member and adapted to be aligned with the first set of bores, and whereby one of said first set of bores and said second bore having an oblong configuration with a major axis in a radial axis to allow thermal radial expansion of the rotor disk and a fastener pin extending through the aligned bores to secure the rotor disk to the hub adapter.

Brief Description of the Drawings

Having thus generally described the nature of the invention, reference will now be made to the accompanying drawings, showing by way of illustration, a preferred embodiment thereof, and in which:

Figs. 1a and 1b are perspective views of the rotor assembly in accordance with the present invention;

Fig. 2 is a front elevation of the rotor assembly in accordance with the embodiment of Fig. 1a and Fig. 1b;

Fig 3 is a rear view of the rotor assembly shown in Fig. 2;

Fig. 4 is a radial cross-section taken along lines A-A of Fig. 2;

Fig. 5 is an exploded perspective view taken from the front of the rotor assembly;

Fig. 6 is an exploded perspective view taken from the rear of the rotor assembly;

Fig. 7 is an enlarged fragmentary cross-section of a detail shown in Fig. 4;

Fig. 8 is a fragmentary, enlarged, perspective view, partly in cross-section, showing a disc brake rotor in accordance with another embodiment of the present invention; and

Fig. 9 is an enlarged, fragmentary, perspective view of the embodiment of Fig. 8.

Mode for Carrying out the Invention

The brake assembly 10 as shown in the drawings includes an annular rotor disk 12 and a hub adapter 14. The annular rotor disk 12 includes radial apertures 16 defining cooling fins 18 therebetween. A pair of opposed radial friction surfaces 20, 22 extend uninterrupted about the annular rotor disk 12.

In the annular rotor disk assembly 10, both elements can be made of different materials. The hub adapter 14 could be made of aluminum while the rotor disk 12 could be made of a more wear-resistant cast material, such as steel.

The rotor disk 12 also includes radially inwardly extending scalloped mounting brackets 24 provided with bores 26. The hub adapter 14 has an axial component and a radial component. The radial component is a continuous annular rim 28 that extends in a radial plane. The axial component is a cylindrical member 30. Cooling fins 32 are provided on the

cylindrical member 30 while cooling fins 34 are provided on the radial rim 28. Splines 36 are provided on the inner cylindrical surface of the cylindrical member 30 to engage a hub of a driven wheel. The radial rim 28 is provided with bores 29 that correspond with the bores 26.

The brake assembly is cooled by air flowing about the brake assembly and through the disk by means of apertures 16. Cooling is effected by air moving past the cooling fins 32, 34, and 18.

The bores 26 are somewhat oblong, that is, having a longer radial axis than the tangential axis. Bolts 38 extend through the bore 26 and the bore 29 in the radial rim. The bolt 38 cooperates with a threaded sleeve 44 through the bores. A washer 40 may be provided and a belleville washer 42 supplements the force exerted between the bolt head 46 on bolt 38 and the sleeve head 48 on sleeve 44 to firmly hold the scalloped bracket members 24 against the radial rim 28. However, since the bore 26, as shown in Fig. 7, is oblong, thermal expansion differences between the material of the annular rotor disk 12 and the hub adapter 14 can be compensated. For instance, the rotor may grow more rapidly than the annular rotor disk, thereby taking up the slack provided by the oblong opening 26.

Referring now to the embodiment of Figs. 8 and 9, there is shown an annular rotor disk 110 having parallel, annular, radial friction surfaces 112 and 114. Cooling channels are defined at 116 which extend in a radial plane from the inner circumference to the outer circumference of the annular disk 110.

A hub adapter 118 is concentric with the radial, annular rotor disk 110. The hub adapter 118 includes a radial component in the form of lugs 128 extending from the cylindrical, axial ring 119. A plurality of axially extending ribs 120 is provided on the inner surface of ring 119 to

engage a hub (not shown) as is known from International Application WO 98/29671.

The rotor disk 110 is provided with circumferentially spaced-apart pairs of inwardly extending lugs 122. Each pair of lugs 122 includes identical lugs 122a and 122b defining a recess 124 therebetween. Axially aligned openings 126a and 126b are provided in lugs 122a and 122b respectively. Each of the openings 126a and 126b has a radially oblong configuration as will be described herein in more detail.

The hub adapter 118 is provided with radially extending, central lugs 128 which are designed to fit in the recesses 124 formed by lugs 122a and 122b in the rotor disk 110. Each lug 128 includes a bore 130 designed to be aligned with openings 126a and 126b when assembled.

Fastener pins or bolts 132, each having a head 134 and a threaded nut 136, are provided for fastening the rotor disk 110 to the hub adapter 118. As shown, the bolt 132 extends through the oblong openings 126a and 126b of lugs 122a and 122b respectively and through the bore 130 of lug 128. The radially oblong configuration of the bores 126a and 126b, as shown in Fig. 8, allows for thermal growth, in the radial direction, of the rotor disk 10 relative to the hub adapter 118.

The advantage of the embodiment of Figs. 8 and 9 is that the connection between the hub adapter 118 and the annular rotor disk 110 is symmetrical and, therefore, any distortions created in rotor disk 110 because of heat and/or structural imbalance is reduced during operation.

CLAIMS:

1. A rotor disk assembly for a disk brake including an annular rotor disk with at least an inward projection, the rotor disk having at least one radial friction surface, a hub adapter having a cylindrical component and a radial rim, fastener means extending between the radial rim of the hub adapter and the inward projection of the annular rotor disk to connect the hub adapter to the annular rotor disk in order to permit differential thermal expansion to occur between the annular rotor disk and the hub adapter.

2. A rotor disk assembly as defined in claim 1, wherein the radial rim is provided with circumferentially spaced-apart axial first bores and the at least inward projection having corresponding second bores adapted to be aligned with the first bores and one of the first and second bores having an oblong configuration with a major axis in the radial direction in order to allow thermal expansion of the annular rotor disk relative to the hub adapter.

3. The rotor disk as defined in claim 1, wherein the annular rotor disk is made of a first material and the hub adapter is made of a second material.

4. A rotor disk assembly, for a full contact annular disk brake, comprising a hub adapter, an annular rotor disk connected to the hub adapter, the improvement comprising radial components on the hub adapter, the annular rotor disk having a complementary connecting means securing the annular rotor disk to the radial components on the hub adapter; the radial components on the hub adapter and the connecting means on the annual rotor disk including circumferentially spaced-apart pairs of symmetrical axially spaced-apart members on one of the rotor disk and the

hub adapter; and circumferentially spaced-apart unitary members on the other of the rotor disk and hub adapter; and each unitary member adapted to fit between a corresponding pair of axially spaced-apart members; a first set of aligned bores extending through each pair of axially spaced-apart members and a second bore extending through the corresponding unitary member and adapted to be aligned with the first set of bores, and whereby one of said first set of bores and said second bore having an oblong configuration with a major axis in a radial axis to allow thermal radial expansion of the rotor disk, and a fastener pin extending through the aligned bores to secure the rotor disk to the hub adapter.

5. The rotor disc assembly as defined in claim 2, wherein the first material is a cast steel and the second material is aluminum.

6. The rotor disc assembly as defined in claim 3, wherein the hub adapter is made of a first material and the annual rotor disc is made of a second material.

7. The rotor disc assembly as defined in claim 5, wherein the first material is a heat resistant cast steel and the second material is aluminum.

8. The rotor disc assembly as defined in claim 1, wherein the fastener means includes a nut and bolt assembly and a concentric sleeve with the sleeve head abutting the radial rim.

9. The rotor disc assembly as defined in claim 3, wherein the fastener pin is a bolt extending through the aligned bores with the bolt head abutting against an exterior surface of the pair of the axially spaced-apart members and a nut engages an opposite surface.

10. The rotor disc assembly as defined in claim 3, wherein the unitary members are located on the exterior periphery of the hub adapter and the pairs of axially spaced-apart members extend inwardly from the rotor disc and sandwich the unitary member.

11. The rotor disc assembly as defined in claim 10, wherein the first set of bores have an oblong configuration.

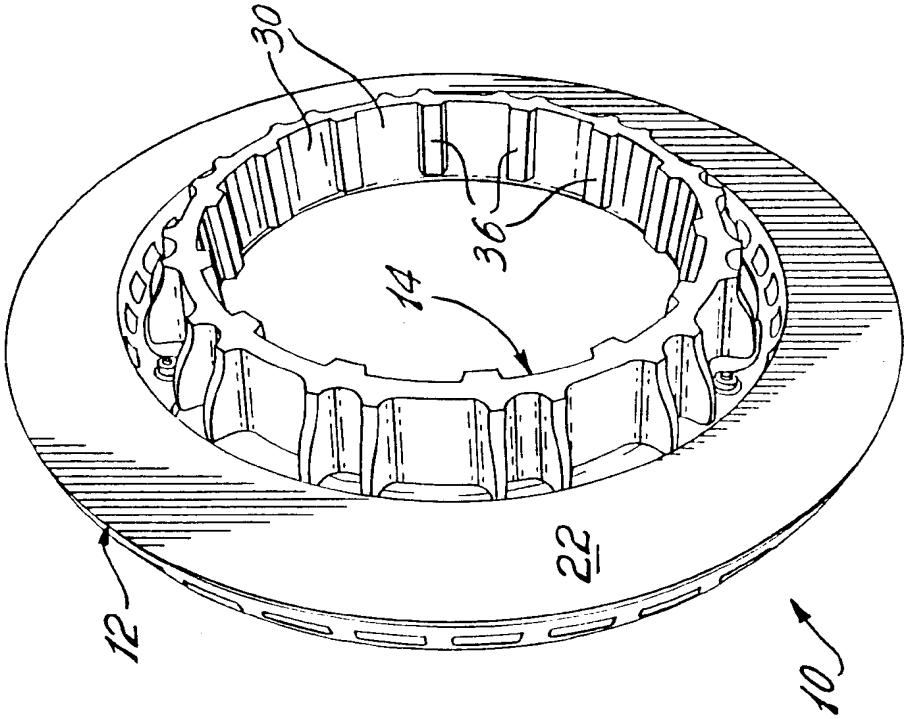

Fig. 1b

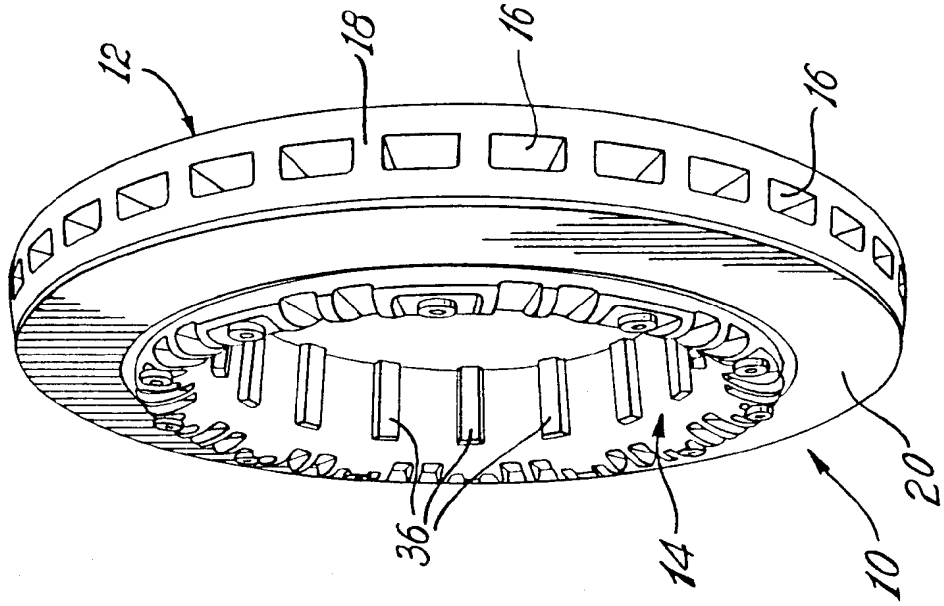

Fig. 1a

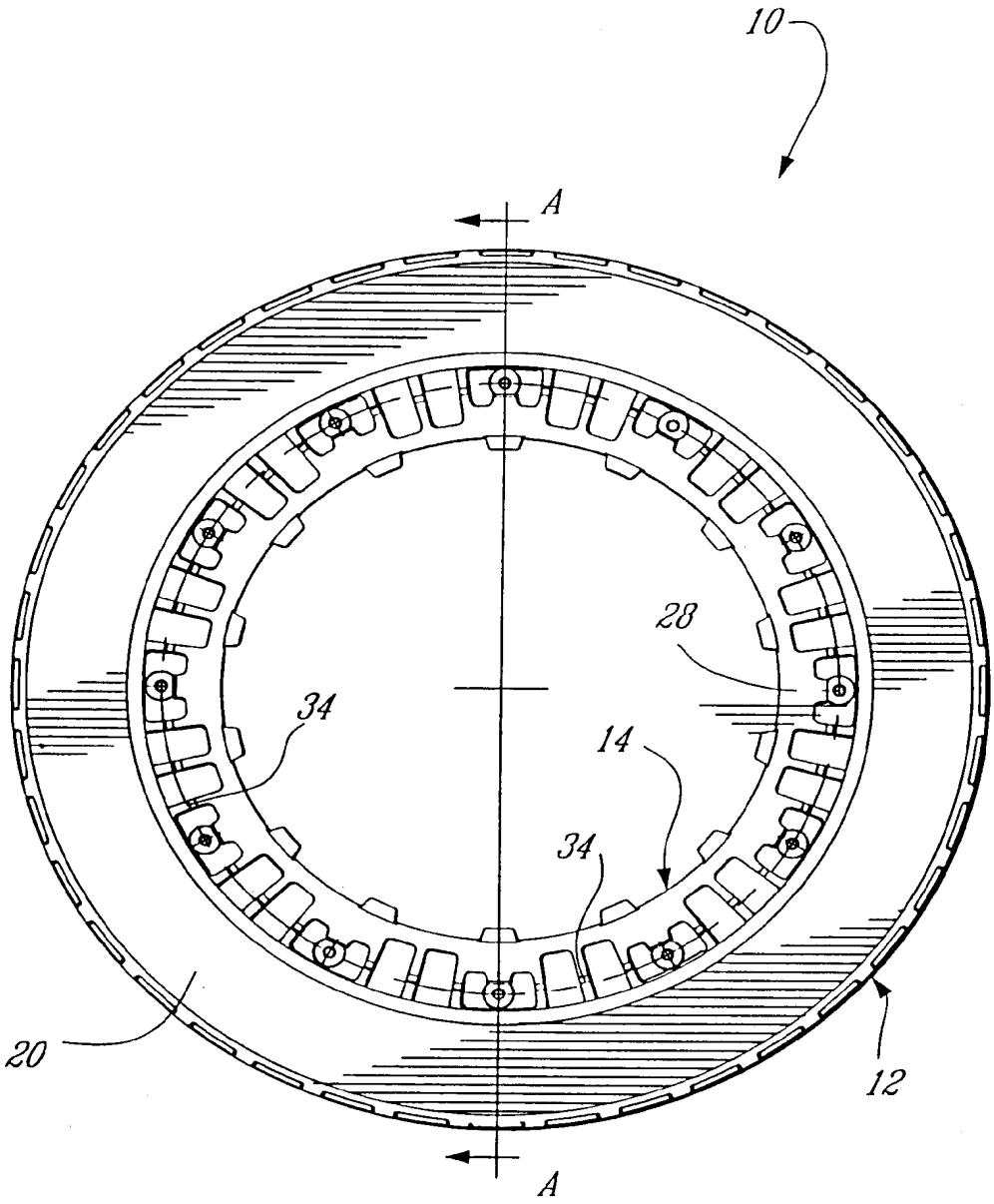

Fig. 2

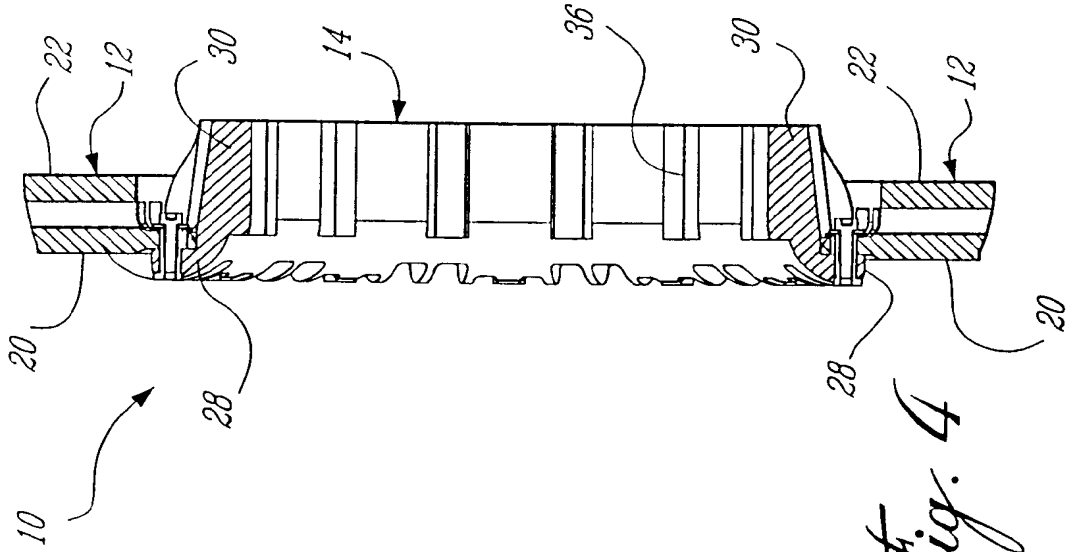

Fig. 4

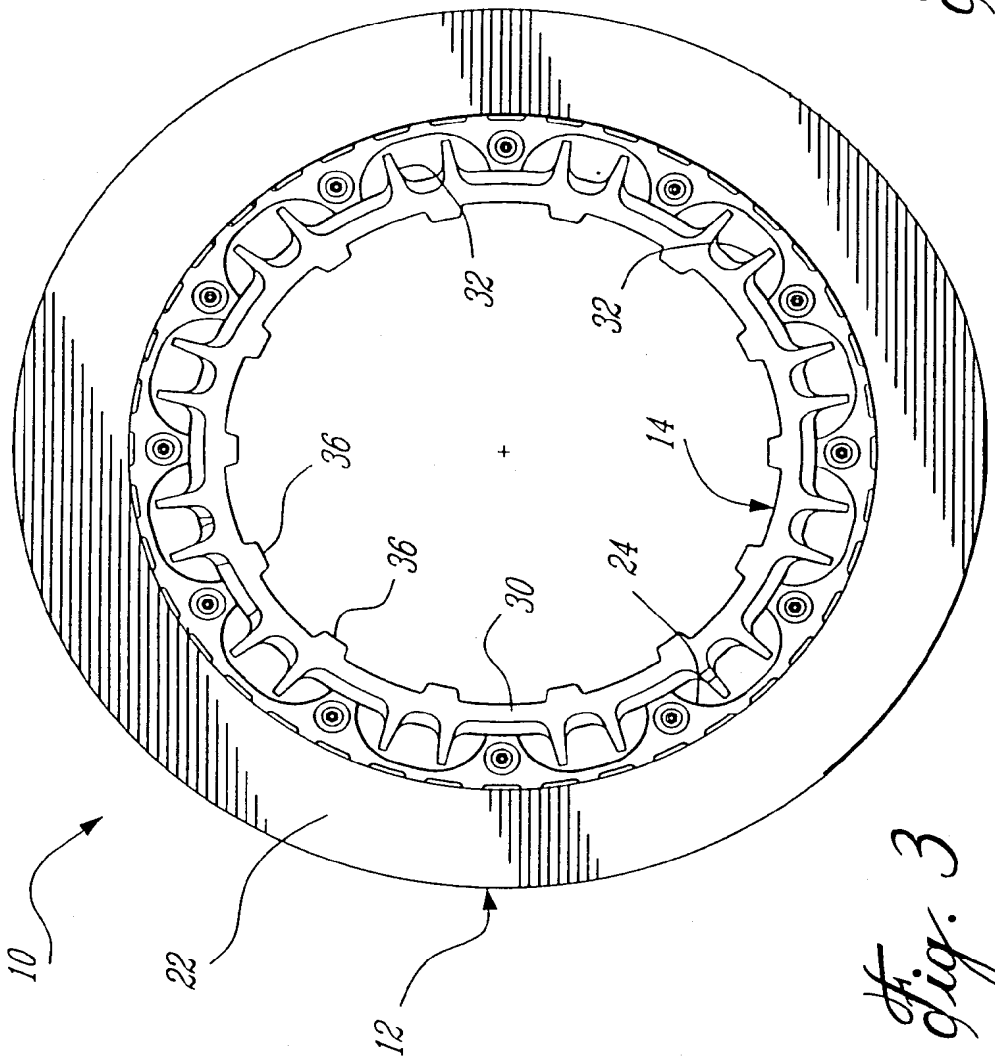

Fig. 3

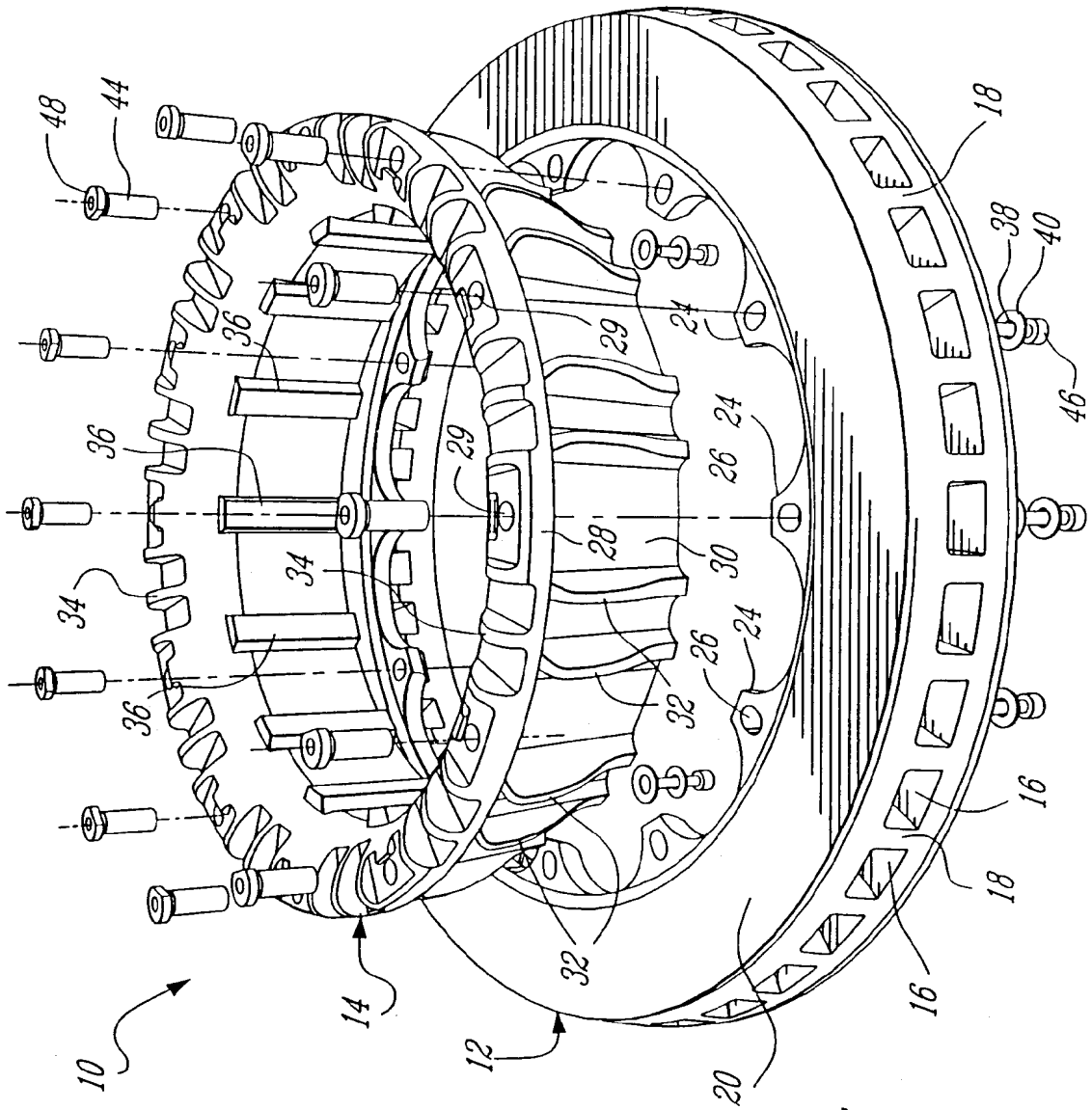
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Fig. 5

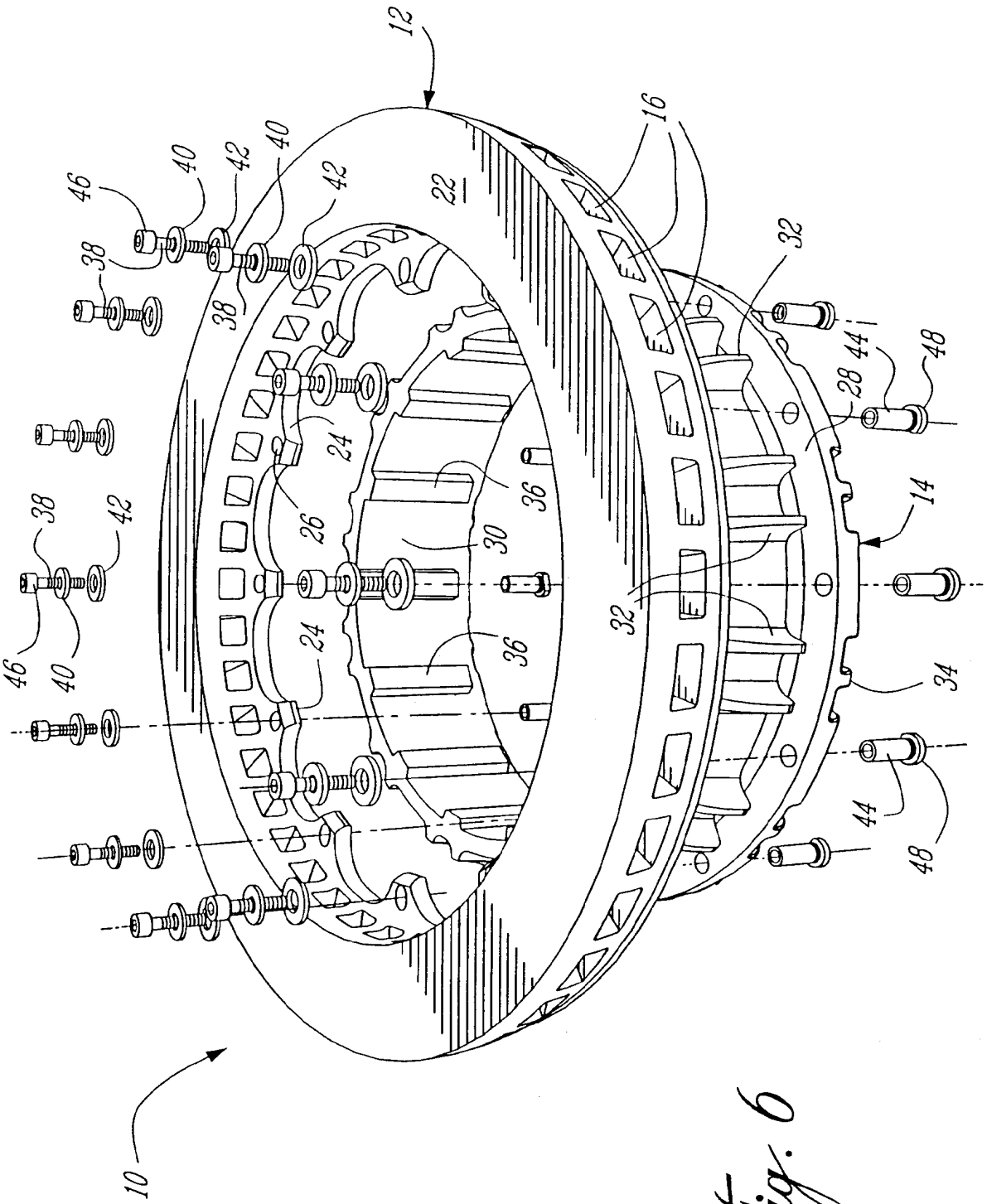

Fig. 6

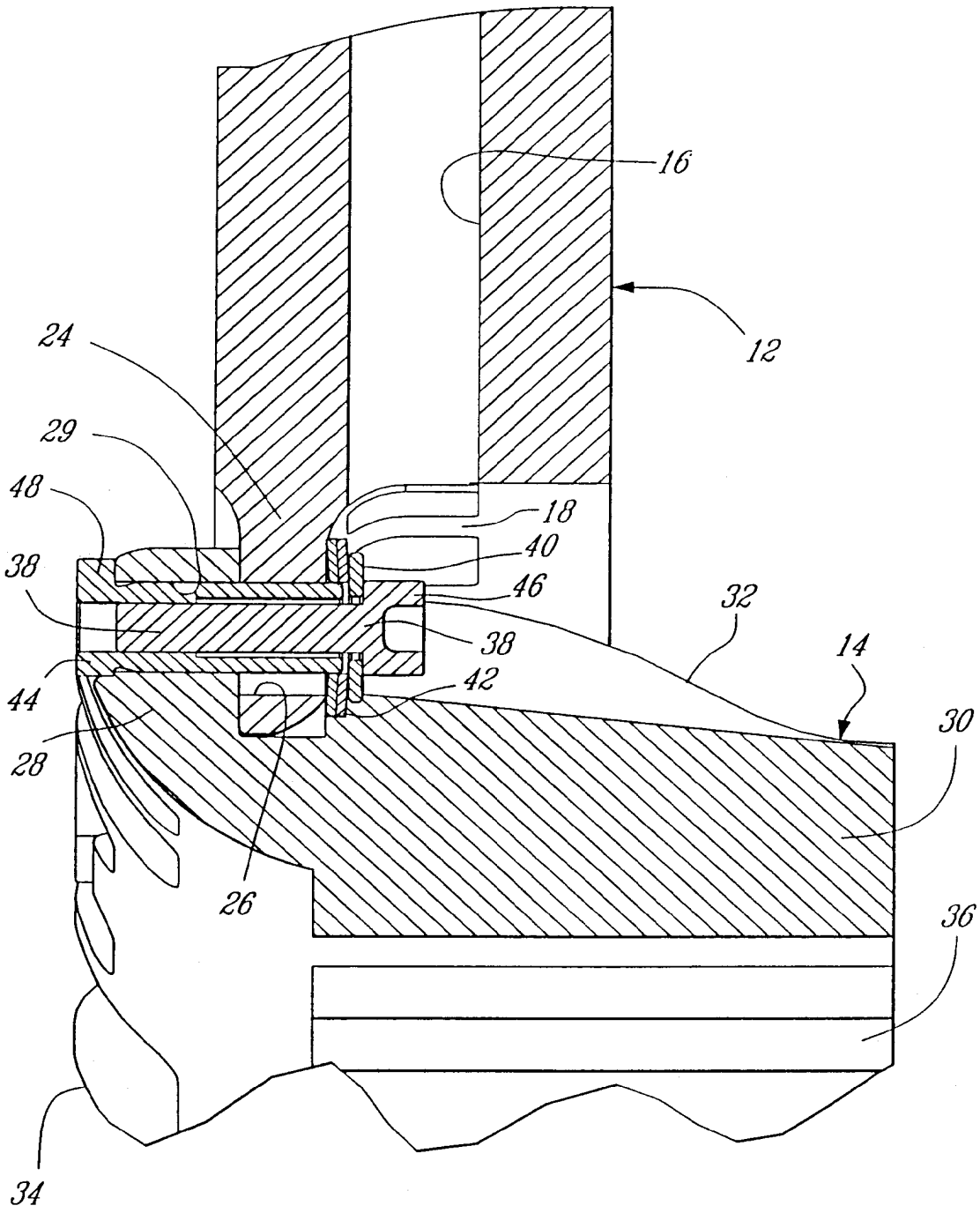

Fig. 7

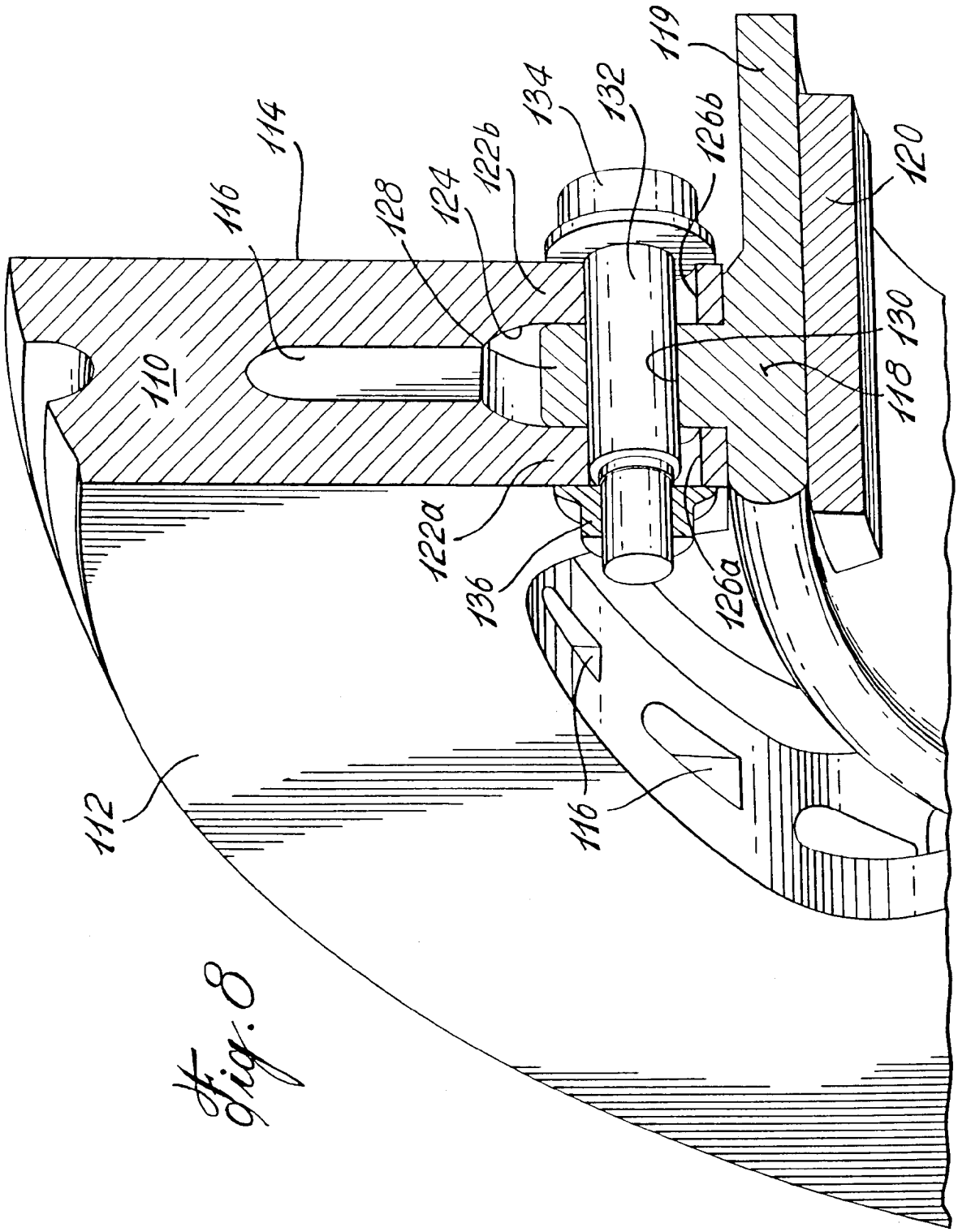
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Fig. 8

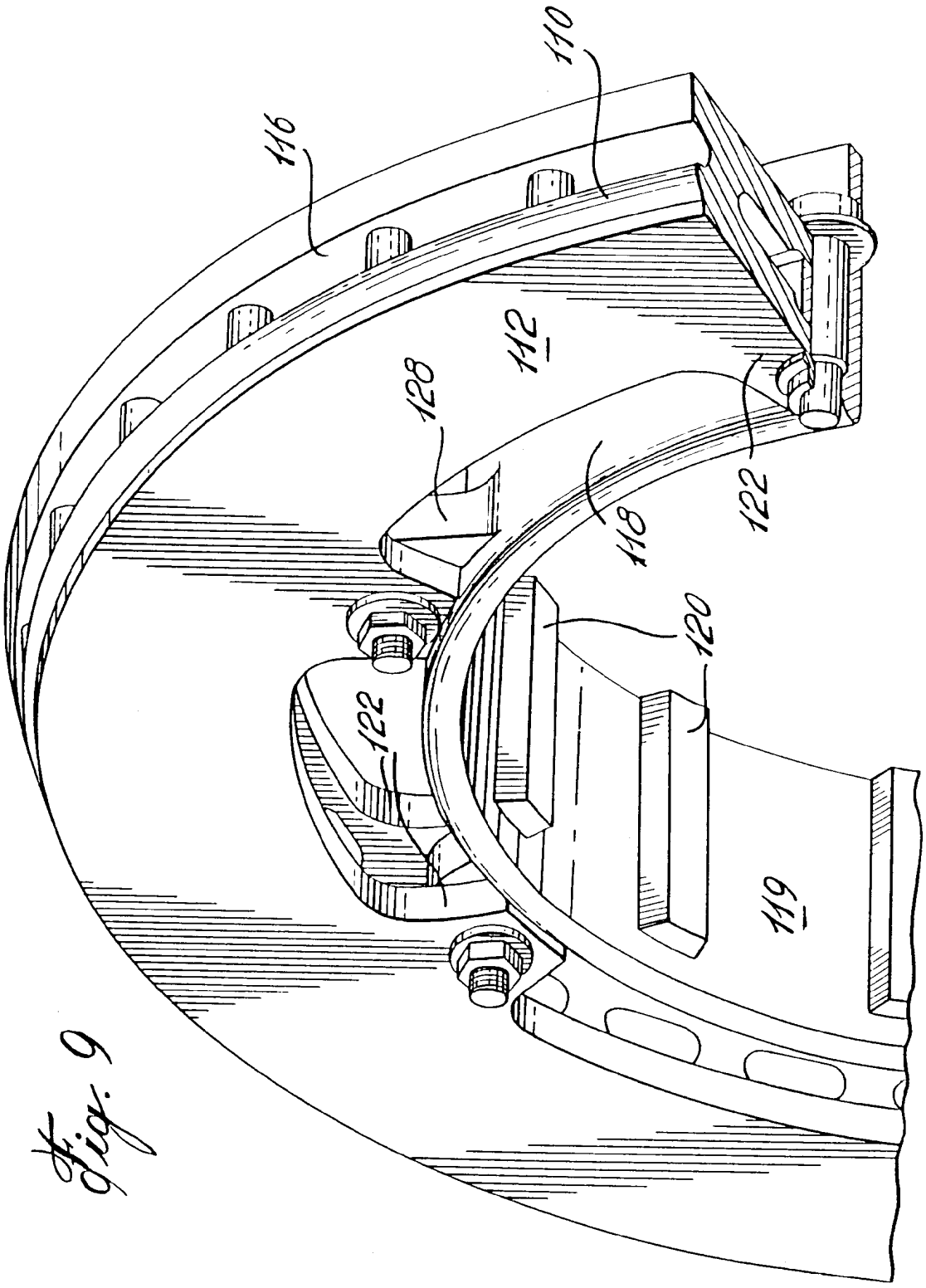

Fig. 9

INTERNATIONAL SEARCH REPORT

Int ional Application No
PCT/CA 00/01360

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16D65/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 28 28 137 A (KNORR BREMSE GMBH) 10 January 1980 (1980-01-10) page 4, line 17 -page 5, paragraph 2 page 7, line 9 -page 9, paragraph 3; figure 1 ---	1,4
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A	DE 196 17 154 A (KNORR BREMSE SYSTEME) 6 November 1997 (1997-11-06) column 5, line 4 -column 7, line 8; figures 1-7 --- -/--	1,4

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 March 2001	08/03/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Blurton, M

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Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Inte ional Application No
PCT/CA 00/01360

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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